MONOGRAPTUS CF. *ULTIMUS* PERNER AND *MONOGRAPTUS FORMOSUS* BOUČEK FROM THE HUME SERIES OF THE YASS DISTRICT, NEW SOUTH WALES

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(Plate XI)

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Synopsis

Monograptus cf. *ultimus* and *M. formosus* described in this paper have not previously been recorded from Australia. The fauna represents the highest graptolite zone so far recorded from the Yass district and is correlated with the Bohemian zone of *M. ultimus* at the base of Přidoli Schichten (Upper Budňany Stufe, Eβ2).

INTRODUCTION

The graptolites described here, *Monograptus formosus* Přibyl and *M.* cf. *ultimus* Perner, were collected from a small shale quarry on the northern side of the Hume Highway approximately fifty yards west of the bridge across Derrengullen Creek, four miles north-west of Yass. The locality, which is in the shales of the Hume Series on the eastern side of the Yass Basin (Brown, 1941), was first discovered by Dr. A. N. Carter in 1957. A specimen collected by him was figured by Thomas (1960) as *Cyrtograptus insectus.* The material described here in addition to Carter's specimen was collected by me in 1959.

The geological map of the Yass district (in Brown, 1941) indicates that the horizon of this graptolite locality is higher than the Dalmanites bed but within a hundred feet of it. The Dalmanites bed is an important marker horizon which extends around all but the northern part of the basin at about the middle of the 700 to 800 feet of sediment comprising the Hume Series. Brown and Sherrard (1952) have previously recorded a variety of graptolites from the Hume Series. Their most significant fauna is from immediately below the Dalmanites bed. It contains forms Sherrard identified as *M. bohemicus*, *M. nilssoni*, *M. roemeri*, *M. crinitus* and *Linograptus* sp. and attributed to the zone of *M. nilssoni.* In sandstones above the Dalmanites bed, six miles south of the locality at which *M.* cf. *ultimus* and *M. formosus* were found, the same authors recorded *M. salweyi*, a species occurring in the British zone of *M. scanicus.* It appears from what they say that the same species occurs in beds up to 200 feet above the Dalmanites bed. *M. salweyi* has been identified by Sherrard in the same paper from a locality near Silverdale and 2½ miles north-north-west of the Derringullen Creek locality. This locality for *M. salweyi* is also apparently stratigraphically above the Dalmanites bed and also above the level of the *M. formosus* and *M.* cf. *ultimus* locality.

In Europe, the stratigraphic range of *M. ultimus* is from the zone of *M. leintwardinensis* (*M.* cf. *ultimus* of Elles & Wood, 1910, and Tomczyk, 1956) to the Bohemian zone of *M. ultimus* at the base of the Upper Budňany Stufe (basal Eβ2) and its equivalents (Přibyl, 1944, E. & H. Tomczyk, 1962). The species *M. formosus* is confined to the Bohemian zone of *M. ultimus.* Although there seems to be no general agreement amongst European workers about the exact zonal succession between the zones of *M. leintwardinensis* and *M. ultimus*, it is agreed that there are at least two intervening zones. The graptolites from Derrengullen Creek can be referred to the zone of *M. ultimus* which is at least four zones higher than the *M. scanicus* zone (and five zones above the *M. nilssoni* zone !). If the stratigraphic relationship of the *M. formosus* beds to those containing the graptolite identified as *M. salweyi* is as suggested above, the ages assigned to the two horizons present a contradiction. The difficulty may be resolved by a re-identification of the *M. salweyi* material. This occurs in sandstone and its mode of preservation in the specimens studied by Sherrard renders the interpretation of its morphology difficult. Recently this suggestion has been independently confirmed by Dr. H. Jaeger (pers. comm.) who has made extensive collections of Sherrard's *M. salweyi* from the Silverdale locality and reidentified it as *M. bouceki* Přibyl, a species found a little higher than the *M. ultimus* zone in the upper part of the Budňany Stufe of Bohemia. The identification of *M. formosus* presents little difficulty since its morphology is extremely distinctive amongst late Silurian graptolites. The recognition of the zone of *M. ultimus* at this level of the Hume Series raises the possibility that the highest beds of the series may be Lower Devonian. (For a discussion of the correlation of the higher parts of the Silurian and the Silurian-Devonian boundary, see Jaeger 1965 and 1966).

All specimens mentioned in this paper are in the palaeontological collection of the University of Sydney.

MONOGRAPTUS FORMOSUS Bouček

(Plate XI, figures 4, 7)

1931, *Monograptus formosus* Bouček, pp. 301, 311, text-fig. 9 b, c.
1931, *Monograptus purkynei* Bouček, pp. 301, 311, text-fig. 9 a.
1941, *Monograptus* (*Spirograptus*) *convexus* Přibyl, p. 73, pl. 1, fig. 12.
1946, *Spirograptus formosus* (Bouček) ; Přibyl, p. 36, pl. 9, fig. 4.
1960, *Cyrtograptus insectus* Bouček ; Thomas, pl. 13, fig. 180.
1962, *Monograptus formosus* Bouček ; Willefert, p. 33, text-pl. fig. 8, pl. 2, fig. 18.

Material and preservation—Twelve fragmentary specimens, three of which are preserved in very low relief and the remainder are flattened films lacking internal detail. Specimen numbers S.U.P. 23,620-1 & 23,626-35.

Description—The largest specimen is 17 mm. long (measured around its arcuate length. The rhabdosomes are arcuate with a varying radius of curvature, in two of the specimens with the sicula preserved, the initial portion (1 mm. in one specimen and 3 mm. in the other) is almost straight, the curvature increases rapidly then diminishes gradually distally. The radius of curvature of the more strongly curved portions is as small as 3 mm. The most distal parts are again almost straight. The largest rhabdosome bends through 120 degrees. The width at the first theca is about 0·8 mm. increasing gradually distally to a height of 1·4 mm. The hooked portion of the thecae make up approximately $\frac{3}{4}$ of the rhabdosome width proximally decreasing to $\frac{1}{2}$ distally.

The sicula is visible but poorly preserved in several specimens, it is almost straight on the ventral side and gently convex on the dorsal side. Its length is around 1·0 to 1·2 mm. and its width at the aperture 0·15 mm. in relief and up to 0·3 mm. in flattened specimens. Only about 0·1mm. of the sicula is exposed below the base of the first theca. The apex of the sicula is at about the distal extremity of the first theca or slightly distal to it.

The thecae are initially triangular with negligible overlap but distally the overlap becomes significant as the free portion of the theca occupies a smaller proportion of the rhabdosome width. In the initial thecae the free proximal thecal wall (proximal to the aperture) is nearly straight before curving into the hook, and is inclined to the dorsal side of the rhabdosome at about 20 degrees. The angle of inclination is more variable but generally higher distally, ranging from 20 to 35 degrees. The angle of inclination of the thecal margin increases where it passes proximally into the interthecal septum in the overlapping distal thecae. Although the amount of overlap is not readily determinable, in specimen S.U.P. 23,620 (Pl. 1, fig. 4) it reaches approximately 0.5 mm. The distal free walls of the thecae are also inclined to the rhabdosome length at an acute angle throughout the rhabdosome so that the axis of the thecae proximal to the hook proper is directed strongly distally. The angle of inclination of this distal wall to the dorsal side of the rhabdosome is around 60 or 70 degrees. In some specimens this wall is straight for up to 0·4 mm. in others it is gently curved, passing into the hook. The thecae narrow to 0·2 to 0·3 mm. where the hook commences. The appearance of the hook varies tremendously with aspect. In specimen S.U.P. 23,620 (pl. 1, fig. 4) most of the thecae are preserved in profile view and appear to be tightly bent through 180 degrees. In specimen S.U.P. 23,621 (pl. 1, fig. 7) the rhabdosome is twisted and thin lateral prolongations on the apertures can be seen. The various aspects preserved give the impression that the thecae strongly resemble Sudbury's reconstruction of the thecae of *M. planus* (Sudbury, 1958, pl. 22, fig. 92), except that the angle through which the hook bends is slightly greater and the lateral prolongations of the apertural region are longer. The interthecal distance measured at the deepest points of incision between the thecae, give a measurement of about 1·1 mm. proximally (9 thecae per cm.) and about 0·8-1·0 mm. distally (10-12 thecae per cm.).

Remarks—The morphology of this species is most distinctive amongst Upper Silurian graptolites. From an examination of the literature and the present material, the chief diagnostic features are the arcuate rhabdosomes with hooked thecae, with the initial thecae high (well over ½ mm.) and not overlapping, the later thecae overlapping about ⅓, the incisions between thecae occupying ¾ of the width of the rhabdosome proximally and ½ distally. Distal thecae are 10 to 12 per cm., the proximal ones are spaced at 7-9 per cm.

The present specimens differ slightly from those described from Bohemia by Přibyl (1946) in two main respects, the thecae are slightly more closely spaced (8 to 10 in the Bohemian specimens with occasional proximal measurements of 7 per centimetre) and the rhabdosomes are more distinctly curved. However the sample of specimens from Yass is very small and may not be entirely representative of the population.

The largest specimen, S.U.P. 23,620 (Pl. 1, fig. 4), is the one collected by Dr. A. N. Carter and figured by Thomas (1960) as *Cyrtograptus insectus* Bouček. *C. insectus* is an early Wenlockian species which has far less isolate thecae in which the incision between the proximal thecae is half the width of the rhabdosome and ⅓ to ¼ distally (Bouček, 1933). Thomas interpreted the fragment adjacent to the eighth theca of the specimen as a branch.

Monograptus sp., cf. Monograptus ultimus Perner
(Plate xi, figs 1-3, 5, 6)

1899, *Monograptus ultimus* Perner, pp. 13-14, text-figs 14a, b, pl. 14, figs 4, 5, 11a, 11b.
1900, *Monograptus ultimus* Perner ; Wood, p. 461, text-fig. 13, pl. 25, figs 9A, 9B.
1910, *Monograptus* cf. *ultimus* Perner ; Elles and Wood, pp. 383-384, text-figs 253a-c, pl. 37, figs 14 a-d.
1935, *Monograptus* cf. *ultimus* Perner ; Decker, p. 443, fig. 25.
1941, *Monograptus* (*Pristiograptus*) *ultimus* Perner ; Přibyl, pp. 69-70, pl. 1, figs 9-11.
1944, *Pristiograptus ultimus* (Perner) ; Přibyl, pp. 35-36, text-fig. 2, A, B, pl. 4, figs 7-11.
1947, *Monograptus* cf. *ultimus* Perner ; Ruedeman, p. 488, pl. 84, fig. 35.
1956, *Monograptus* cf. *ultimus* Perner ; Tomczyk, p. 54-55, 116-117, text-fig. 15c, d, pl. 7, fig. 3 a-c.
1962, *Monograptus ultimus* Perner ; Willefert, p. 33, text-pl. fig. 7, pl. 2, fig. 7.

Material and preservation—Approximately 60 specimens which are fairly complete are available, eleven of them are preserved in half relief. These latter, which were originally pyritised, but now weathered to limonite, show traces of half rings in the partially preserved periderm. The remainder of the specimens are preserved as thin flattened films possessing little internal detail. Specimen numbers S.U.P. 23,622-5 & 23,636-97.

Remarks—The form identified as *M.* sp. cf. *M. ultimus* is small with specimens reaching 17 mm. in length but mostly about 7 or 8 mm. long with a gentle dorsal curvature extending over 5 to 6 mm. The rhabdosomes have a maximum width of 1·0 to 1·1 mm. in most specimens.

Several of the better preserved specimens have morphological features worthy of special comment. A section ground through a weathered pyritised specimen from Yass, preserved in half relief (Pl. 1, fig. 6) has revealed the shape of the thin interthecal septum. The septum ends proximally in a rod-like thickening approximately 0·05 mm. in diameter. The common canal occupies just a fraction under half of the width of the rhabdosome. The basal thickening of the interthecal septum has resulted in the formation of a raised boss on incompletely compressed specimens and a thicker carbonaceous impression in many of the flattened specimens. Associated with this boss in many of the partially compressed specimens is a groove running from the point of emergence of the interthecal septum thickening towards the dorsal surface (Pl. 1, fig. 5). The groove becomes shallower dorsally, but in its ventral part there is a thick carbonaceous deposit, presumably marking a thickening and possibly an indentation of the periderm at the junction of two thecae. This structure is oblique to growth rings when they can be detected. The interthecal thickening can be recognised in many of the flattened specimens.

There are two species, *M. haupti* Kühne and *M. praeultimus* Münch have close morphological affinities with *M. ultimus* and closely resemble each other. *M. haupti* is recorded only from isolated material and *M. praeultimus* only from shale material. Both occur in the zone of *M. scanicus*. Urbanek (1958) has made the suggestion that they might be conspecific. *M. haupti* as described by Urbanek (1958) differs from the Yass specimens of *M.* cf. *ultimus* in three respects. 1. The sicula is shorter (1·4 to 1·76 mm. as against 1·7 or possible 1·5, to 2·0 mm.). 2. There are more thecae in 5 mm. (7 as against 5 to 7 but mostly 5½ or 6). 3. The curvature of the ventral thecal wall is greater in *M. haupti* (compare pl. 1, fig. 6 with Urbanek, 1958, fig. 64). The shape of the siculae in Urbanek's illustrations is similar to that of the present specimens of *M.* cf. *ultimus* and less ventrally curved than the siculae of the original specimens of *M. haupti* described by Kühne (1955). The data available in Münch's description and illustrations of *M. praeultimus* (Münch, 1942), are very incomplete, but it would appear that the rhabdosomes are shorter and the thecae may be more closely spaced and have a stronger sigmoidal curvature of the ventral wall.

The description given by Přibyl (1944) in his revision of the Bohemian representatives of *M. ultimus*, compares closely in many respects with the Yass material. The degree of curvature of the thecal wall is similar, so too are the overall dimensions of the rhabdosomes, but the first theca of Bohemian specimens seems to be more prominent and of rather different shape in some illustrations. A length of 2·0 mm. is quoted for the sicula, some of the present specimens have rather shorter siculae, but longer ones than *M. haupti.* Some of the Yass specimens have more distant thecae than the Bohemian ones but most fall within the range of 11 to 14 thecae per centimetre quoted by Přibyl. I am unsure how he made his measurements, possibly it represents the range in number of thecae in any centimetre of rhabdosome. The British specimens described by Elles and Wood (1910) as *M.* cf. *ultimus*, from a lower horizon (the zone of *M. leintwardinensis*), has slightly more distantly spaced thecae and in this respect comes closer to the Yass material. Similar too is the rather lower angle of inclination of the thecae, but the sigmoidal curvature is more gentle in the British material. By inclusion of Elles and Wood's *M.* cf. *ultimus* in his synonymy, Přibyl (1943) is presumably accepting a good deal of morphological variation within the species. The relationship of this Yass form to *M. ultimus* should be left provisional until the Bohemian type material is more fully described and better figures are published.

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References

Brown, I. A., 1941.—The stratigraphy and structure of the Silurian and Devonian rocks of the Yass-Bowning district, New South Wales. *J. Proc. roy. Soc. N.S.W.*, 74 : 312-341.

————, and Sherrard, K. M., 1952.—Graptolite zones in the Silurian of the Yass-Bowning district of N.S.W. *J. Proc. roy. Soc. N.S.W.*, 85 : 127-134.

Bouček, B., 1931.—Communication preliminaire sur quelques nouvelles especès de Graptolites provenant du Gothlandien de la Bôheme. *Věst. geol. ústav. Cesk.*, 7 : 293-312.

————, 1933.—Monographie der silurischen Graptolithen aus der Familie Cyrtograptidae. *Práce geol.—paleont. ústav. Karlovy. Univ.*, 1 : 1-81.

Decker, C. E., 1935.—Graptolites from the Silurian of Oklahoma. *J. Paleont.*, 9 : 434-446.

Elles, G. L., and Wood, E. M. R., 1910.—A monograph of British Graptolites. Part 8. *Palaeontogr. Soc. London*, 64 : 359-414.

Jaeger, H., 1965.—Symposiums—Band der 2. Int. Arbeitstagung über die Silur/Devon-Grenze und die Stratigraphie von Silur und Devon, Bonn-Bruxelles 1960 (Review). *Geologie*, 14 : 348-364.

————, 1966.—Two late *Monograptus* species from Victoria, Australia and their significance in dating the *Baragwanathia* flora. *Proc. roy. Soc. Vict.*, 79 : 393-413.

Kühne, W. G., 1955.—Unterludlow-Graptolithen aus Berliner Geschieben. *Neues Jb. Geol. Paläont.*, 100 : 350-401.

Münch, A., 1942.—Die Graptolithenfauna des unteren Ludlow von Ronneburg und Umgebung. *Beit. Geol. Thuringen*, 6 : 241-266.

Perner, J., 1899.—Études sur les Graptolites de Boheme. Pt 3B. *Paleont. Bohemiae*, 1-24.

Přibyl, A., 1941.—Die Graptolithenfauna des mittleren Ludlows von Böhmen (oberes eβ). *Zprávy Geol. Úst. Cechya Moravu*, 16 (1940) : 63-73.

————, 1944.—Revision aller Vertreter der Gattung *Pristiograptus* aus der Gruppe *P. dubius* und *P. vulgaris* aus dem böhmischen und ausländischen Silurs. *Bull. inter. de l'Acad. tchèque de Science*, 44 : 33-81.

————, 1946.—The Middle-European Monograptids of the genus *Spirograptus* Gür. *Bull. inter. de l'Acad. tchèque de Science*, 45 : 185-231.

Ruedeman, R., 1947.—Graptolites of North America. *Geol. Soc. Amer. Mem.*, 19 : 1-652.

Sudbury, M., 1958.—Triangulate Monograptids from the *Monograptus gregarius* zone (Lower Llandovery) of the Rheidol Gorge (Cardiganshire). *Phil. Trans. roy. Soc. London*, B 241 : 485-555.

Thomas, D. E., 1960.—The zonal distribution of Australian Graptolites. *J. Proc. roy. Soc. N.S.W.*, 94 : 1-58.

Tomczyk, E., and H., 1962.—Das Problem der Silur/Devon-Grenze in Polen. *Sym. Bd. 2 Int. Arbeitstagung Silur/Devon-Grenze* 274-280.

Tomczyk, H., 1956.—Wenlock and Ludlow in the Kielce Syncline of the Swiety Krzyz Mts. *Inst. Geol. Prace* 16.

Urbanek, A., 1958.—Monograptidae from erratic boulders of Poland. *Paleont. polon.*, 9 : 1-105.

Willefert, S., 1962.—Quelques Graptolites du Silurien Supérieur du Sahara Septentrional. *Bull. Soc. géol. France* (7) 4 : 24-40.

Wood, E. M. R., 1900.—The Lower Ludlow Formation and its graptolite fauna. *Quart. Jour. geol. Soc. London*, 56 : 415-492.

EXPLANATION OF PLATE XI

Fig. 1. Flattened specimen of *Monograptus* sp. cf. *M. ultimus* Perner, S.U.P. 23,622.

Fig. 2. *Monograptus* sp. cf. *M. ultimus* Perner preserved in low relief (portion of the sicula is missing), S.U.P. 23,623.

Fig. 3. *Monograptus* sp. cf. *M. ultimus* Perner with well preserved sicula, S.U.P. 23,624c.

Fig. 4. *Monograptus formosus* Bouček. S.U.P. 23,620.

Fig. 5. Drawing of two distal thecae of *Monograptus* sp. cf. *M. ultimus* Perner specimen preserved in low relief. S.U.P. 23,625.

Fig. 6. Drawing of oblique section through specimen of *Monograptus* sp. cf. *M. ultimus* Perner, preserved in low relief. The section shows the gentle curvature of the ventral thecal wall and the basal thickening of the interthecal septum. S.U.P. 23,625.

Fig. 7. Twisted rhabdosome of *Monograptus formosus* Bouček showing a variety of profiles of the thecae. S.U.P. 23,621.

All figures ×10 except figure 5 which is ×25.

Monograptus sp. cf. *M. ultimus* and *Monograptus formosus*